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Drainage Services Department
The Government of the Hong Kong Special Administrative Region

Contract No. DC/2019/03

Revitalisation Works of Jordan Valley Nullah and Minor Drainage and Sewerage Works in Urban Area and New Territories – Provision of Trunk Sewer to 3 Villages in Tai Po: Ta Tit Yan, Yuen Tun Ha and Lo Lau Uk in Tai Po

Water Quality and Ecological Monitoring Plan

(EP-556/2018 Condition 2.1)

Document No.

ASCL	/	200168084	/	WQEMP	/	4.0
Publisher		Project Code		Sequential No.		Revision Index

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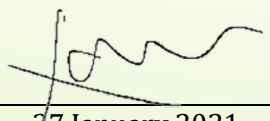
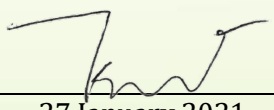
Signature			
Date:	27 January 2021	27 January 2021	27 January 2021

REVISION HISTORY

REV.	DESCRIPTION OF MODIFICATION	DATE
0	First Issue for Comments	27 Apr 2020
1	Revision according to DSD and IEC Comments	27 May 2020
2	Revision according to EPD Comments	18 Sep 2020
3	Revision according to EPD Comments	24 Dec 2020
4	Revision according to EPD Comments	27 Jan 2021

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1. INTRODUCTION

1.1. BACKGROUND

Best Build Construction Co., Ltd. (the Contractor) is contracted to carry out the Revitalisation Works of Jordan Valley Nullah and Minor Drainage and Sewerage Works in Urban Area and New Territories under Contract No. DC/2019/03, where Provision of Trunk Sewer to 3 Villages in Tai Po: Ta Tit Yan, Yuen Tun Ha and Lo Lau Uk in Tai Po (the Project) is included in the scope of the Contract.

Acuity Sustainability Consulting Limited (ASCL) is commissioned by the Contractor to undertake the Environmental Team (ET) services as required in the Particular Specification for the Project; and to carry out the Environmental Monitoring and Audit (EM&A) programme in fulfillment of the Project's EM&A requirements under the Project Profile (PP) for Provision of Trunk Sewer to 3 Villages: Ta Tit Yan, Yuen Tun Ha and Lo Lau Uk in Tai Po (Register No. PP-563/2018) and Contract No. DC/2019/03 Particular Specification requirements.

Pursuant to the Environmental Impact Assessment Ordinance (EIAO), the Director of Environmental Protection granted the Environmental Permit (EP) (No. EP-556/2018) to Drainage Service Department (DSD) for the Project.

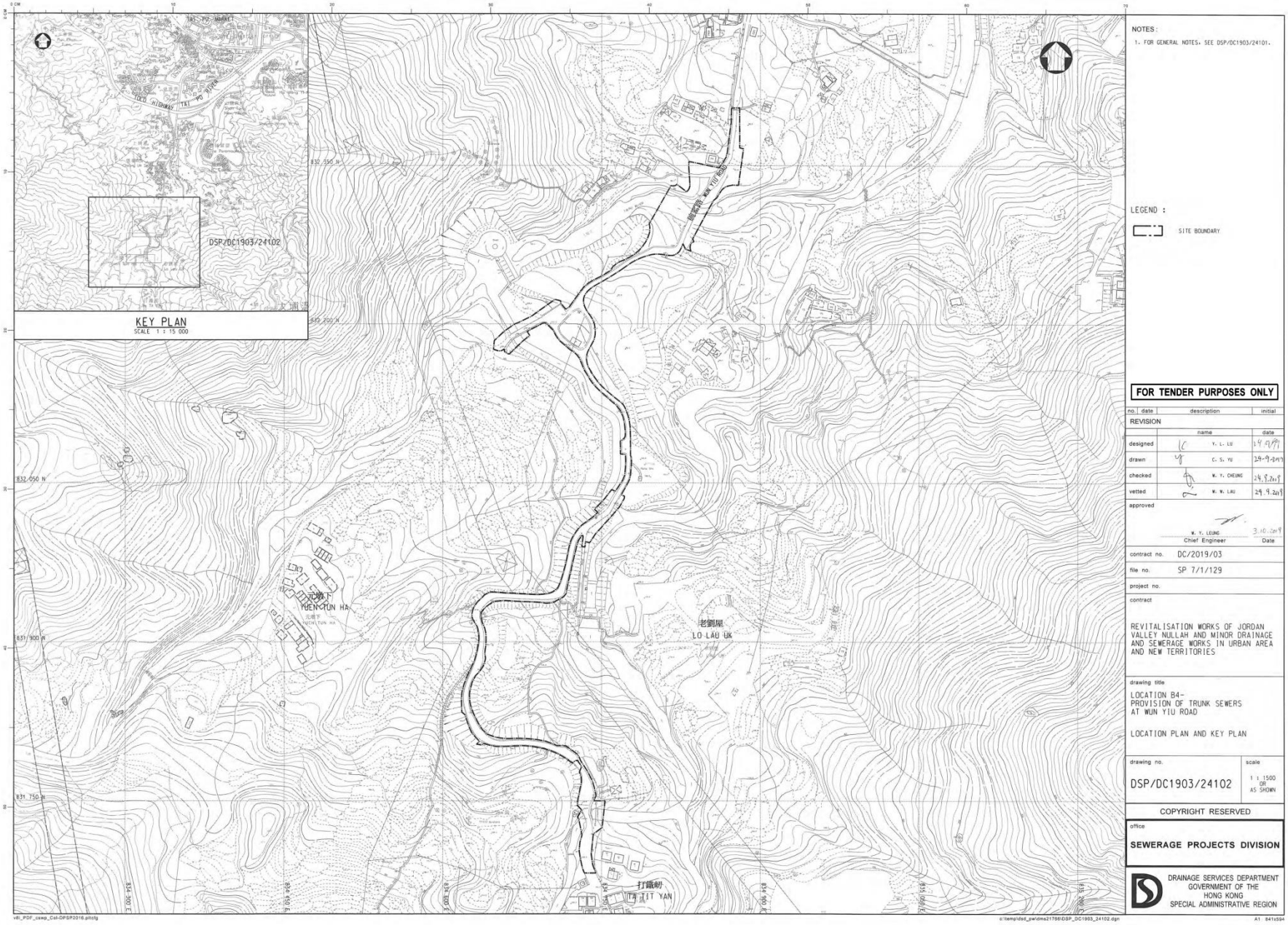
1.2. PROJECT DESCRIPTION

The works to be executed under the Project include:

- Erection of temporary accommodation
- Ground investigation fieldwork
- Road and drainage works
- Pipe laying by trenchless method
- Supply of bituminous pavement materials
- Road marking

Overview of the site locations and extent of works is shown in **Figure 1.1**.

Figure 1.1 Overview of the site locations and extent of works



1.3. PURPOSE OF THE PLAN

Pursuant to condition 2.1 of the EP, this Water Quality and Ecological Monitoring Plan (WQEMP) with provision of details, supported with justifications, on the methodology, equipment, locations, frequency and duration for baseline, impact and post-construction monitoring, water quality action and limit levels, and Event and Action Plans shall be submitted to EPD for approval no later than 4 weeks before the commencement of construction of the Project.

This monitoring plan will present the details for the proposed Water Quality monitoring practice in Section 2; present the details for the proposed Ecological monitoring practice in Section 3; and present the details for Site Environmental Audit practice in Section 4.

2. WATER QUALITY

The PP has assessed the water quality impacts associated with the Project. According to the PP, the water quality impact could be minimised with the implementation of mitigation measures. The water quality monitoring programme as discussed below could ensure the implementation of the recommended mitigation measures and provide continue improvements to the environmental conditions.

2.1. ENVIRONMENTAL MITIGATION DURING CONSTRUCTION PHASE

The PP and EP has recommended mitigation measures on water quality impact during construction phase. The mitigation measures are summarised below:

2.1.1. MITIGATION MEASURES

- Protection of natural watercourses will be in compliance with Environment, Transport and Works Bureau Technical Circular (Works) (ETWB TC(W)) No. 5/2005 《Protection of natural streams/rivers from adverse impacts arising from construction works》;
- Necessary silt removal facilitates will be provided during construction stage so as to remove any silt before discharge of site runoff into nearby stormwater drains; and
- The design of temporary on-site drainage and silt removal facilities will comply with the guidelines stipulated in EPD's Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94).

2.1.2. SPECIAL MEASURES FOR WORKS AT WATER GATHERING GROUNDS (WGG)

- Adequate measures shall be taken to ensure that no pollution or siltation occurs to the gathering grounds.
- Temporary drains with silt traps shall be constructed at the boundary of the site priorto the commencement of any earthworks
- Regular cleaning of the silt traps shall be carried out to ensure that they function properly at all time.
- All excavated or filled surfaces which have the risk of erosion shall be protected from erosion at all time.
- Site formation plans shall be submitted to WSD for approval prior to commencement of work.
- No structure or temporary works shall be erected in the catchwaters without prior approval of WSD
- The Contractor shall be responsible for cleaning frequently any waterworks roads and associated drainage works of mud and debris.

- The approval for using the access may be withdrawn on written notice to the Contractor by WSD at their absolute discretion.
- The Contractor shall recover immediately his vehicle which fell into the catchwater or stream bed or pay to Government on demand the cost of recovery that may be necessary through the occurrence of any incident caused by the Contractor.
- The Contractor shall carry out repair or reinstatement works to the satisfaction of WSD or pay to Government on demand the cost of repair and reinstatement to any waterworks installations that shall or may be necessary at any time as a result of damage caused by the Contractor or others under his charge.
- The Contractor shall enter and remain on and use the access at his own risk and he shall indemnify the Government of Hong Kong from all claims, costs, damages and expense arising from the use of the access.
- No excavation with depth more than 2m shall be permitted within 120m from the centerline of WSD water tunnels without the prior approval of WSD.
- All waterworks access roads must be maintained unobstructed at all time.

2.2. WATER QUALITY PARAMETERS

The monitoring shall normally be established by measuring the dissolved oxygen (DO), temperature, turbidity, salinity, pH, stream flow velocity and suspended solids (SS) in water bodies at all designated locations as specified in Section 2.5.

The measurements shall be taken at all designated monitoring stations 3 days per week. The interval between two sampling surveys shall not be less than 36 hours.

One replicate in-situ measurement shall be conducted and one replicate sample shall be collected from each sampling location in the sampling event to ensure a robust statistically interpretable database. DO, pH value, salinity, temperature, stream flow velocity and turbidity should be measured in-situ whereas other parameters should be determined by an accredited laboratory.

Other relevant data shall also be recorded, including monitoring location / position, time, water depth, weather conditions and any special phenomena or work underway at the construction site.

2.3. MONITORING EQUIPMENT

2.3.1. DISSOLVED OXYGEN AND TEMPERATURE

The dissolved oxygen (DO) measuring instruments should be portable and weatherproof. The equipment should also complete with cable and sensor, and DC power source. It should be capable of measuring:

- DO level in the range of 0 – 20 mg/L and 0 – 200% saturation; and
- temperature of 0 – 45 degree Celsius.

The equipment should have a membrane electrode with automatic temperature compensation complete with a cable.

Should salinity compensation not be built-in to the DO equipment, in-situ salinity should be measured to calibrate the DO measuring instruments prior to each measurement(for example, YSI ProDSS, HORIBA U-53 or an approved similar instrument).

2.3.2. TURBIDITY MEASURING EQUIPMENT

The turbidity measuring instruments should be a portable and weatherproof with DC power source. It should have a photoelectric sensor capable of measuring turbidity level between 0 – 1000 NTU (for example, YSI ProDSS, HORIBA U-53 or an approved similar instrument).

2.3.3. PH MEASURING EQUIPMENT

A portable pH meter capable of measuring a pH range between 0.0 and 14.0 shall be provided under the specified conditions (for example, YSI ProDSS, HORIBA U-53 or an approved similar instrument).

2.3.4. STREAM VELOCITY MEASURING EQUIPMENT

Stream velocity would be measured by portable and weatherproof current meter capable of measuring a current speed range between 0.03 and 5 m/s (for example, Valeport Current Meter Model 106 or an approved similar instrument).

If water at monitoring station is too shallow for use of water current meter, no measurement of stream velocity will be made.

2.3.5. WATER DEPTH MEASURING EQUIPMENT

Due to the shallow water of the stream, a meterstick, instead of echo sounder, will be used for the determination of water depth at monitoring station.

2.3.6. SUSPENDED SOLID TESTING EQUIPMENT

A water sampler is required for SS monitoring. It should comprise a transparent PVC cylinder, with a capacity of not less than 2 litres, which can be effectively sealed with latex cups at both ends. The sampler should have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (for example, Kahlsico Water Sampler or an approved similar instrument).

If water at sampling location is too shallow for use of water sampler, a water bucket made of inert material (e.g. plastic) could be used instead.

Water samples for SS should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen) and shipment to the testing laboratory. The samples shall be delivered to the laboratory within 24 hours of collection and be analysed as soon as possible after collection.

2.3.7. CALIBRATION OF IN-SITU INSTRUMENTS

The pH meter, DO meter and turbidimeter shall be checked and calibrated before use. DO meter and turbidimeter shall be certified by a laboratory accredited under HOKLAS or any other international accreditation scheme, and subsequently re-calibrated at quarterly basis throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter shall be carried out before measurement at each monitoring station.

2.3.8. BACK-UP EQUIPMENT

Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration, malfunction, etc.

2.4. LABORATORY MEASUREMENT / ANALYSIS

At least 3 replicate samples from each independent sampling event are required for the SS measurement which shall be carried in a HOKLAS or international accredited laboratory. Sufficient water samples shall be collected at the monitoring stations for carrying out the laboratory measurement and analysis. The laboratory determination work shall start within 24 hours after collection of the water samples. The analysis for suspended solids is presented in **Table 2.1**.

Table 2.1 Laboratory analysis

Parameters	Analytical Method	Reporting Limit
Suspended Solid (SS)	APHA 2540-D [1]	0.5mg/L

Note:
[1] APHA American Public Health Association Standard Methods for the Examination of Water and Wastewater.

2.5. MONITORING LOCATIONS

Water quality monitoring will be carried out at 2 locations (M1-M2) of the stream/pond nearby the project site during construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS.

The proposed water quality monitoring locations are shown in **Figure 2.1** and listed in **Table 2.2**. Minor shifting of monitoring location is expected due to the rocky nature tarrain of the stream, depends on the stream condition during the monitoring event, the closest available and accessible

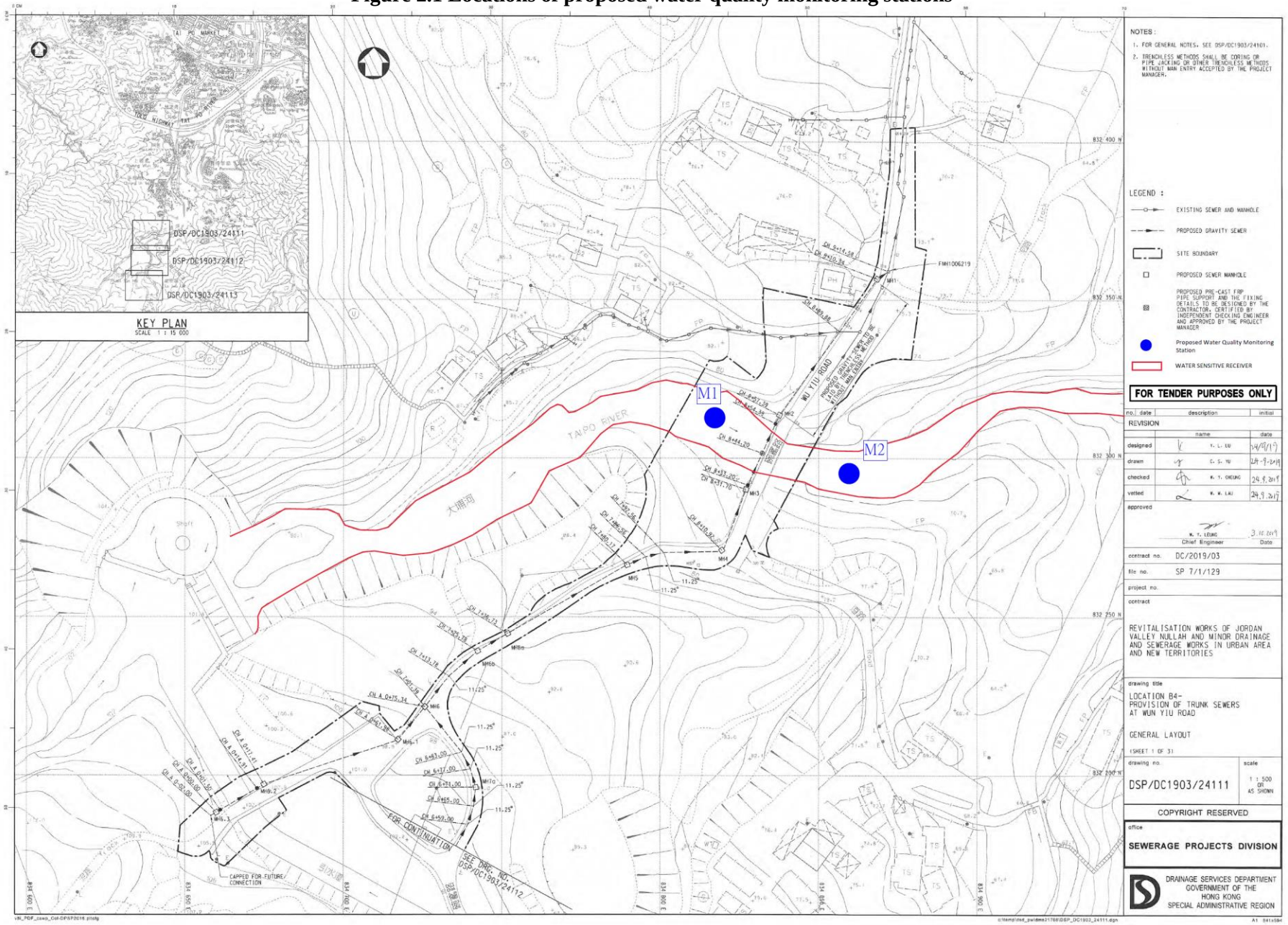
water course at the upstream and downstream direction of Wun Yiu Ecologically Important Stream to the construction location shall be monitored. The ET shall record the coordinate of the actual sampling location for reference when carrying out the monitoring.

The ET shall seek approval from IEC and EPD for any alternative monitoring locations.

Table 2.2 Locations of proposed water quality monitoring stations

Monitoring Station	Location	Easting	Northing
M1	Uptream of Wun Yiu Ecologically Important Stream	834817	832314
M2	Downstream of Wun Yiu Ecologically Important Stream	834855	832296

Figure 2.1 Locations of proposed water quality monitoring stations



2.6. BASELINE MONITORING

Baseline conditions for water quality shall be established and agreed with EPD prior to be commencement of construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS. The purpose of the baseline monitoring is to establish ambient conditions prior to the commencement of the construction works and to demonstrate the suitability of the proposed impact and control monitoring stations.

The baseline monitoring shall be conducted for at least 4 weeks prior to the commencement of construction of the proposed pipe support and any other construction works adjacent to the Wun Yiu EIS. The proposed water quality monitoring schedule shall be submitted to EPD by the ET at least 2 weeks before the first day of the monitoring month. The interval between two sets of monitoring shall not be less than 36 hours. EPD shall also be notified immediately for any changes in schedule.

In general, where the difference in value between the first and second in-situ measurement of DO or turbidity parameters is more than 25% of the value of the first reading, the reading shall be discarded and further readings should be taken.

There should be no construction work in the vicinity of the stations during the baseline monitoring. The baseline data will be used to establish the Action and Limit Levels. The determination of Action and Limit Levels will be discussed in **Section 2.8**.

Table 2.3 below summarises the proposed monitoring frequency and water quality parameters for baseline monitoring.

Table 2.3 Proposed water quality baseline monitoring programme

Item	Baseline Monitoring
Monitoring Period	At least 4 weeks prior to the commencement of construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS
Monitoring Frequency	3 Days in a Week
Monitoring Locations	M1, M2
Monitoring Parameters	Dissolved oxygen (DO), temperature, turbidity, salinity, pH, stream flow velocity and suspended solids (SS).
Intervals between 2 Sets of Monitoring	Not less than 36 hours

2.7. IMPACT MONITORING

The impact monitoring shall be conducted during construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS. The purpose of impact

monitoring is to ensure the implementation of the recommended mitigation measures, provide effective control of any malpractices, and provide continuous improvements to the environmental conditions. The proposed water quality monitoring schedule shall be submitted to EPD by the ET at least 2 weeks before the first day of the monitoring month. The interval between two sets of monitoring shall not be less than 36 hours. EPD shall also be notified immediately for any changes in schedule.

In general, where the difference in value between the first and second in-situ measurement of DO or turbidity parameters is more than 25% of the value of the first reading, the reading shall be discarded and further readings should be taken.

In case of project-related exceedances of Action and/or Limit Levels, the impact monitoring frequency shall be increased according to the requirement of Event and Action Plan. The details of Event Action Plan will be discussed in **Section 2.9**.

Table 2.4 below summarises the proposed monitoring frequency and water quality parameters for impact monitoring.

Table 2.4 Proposed water quality impact monitoring programme

Item	Impact Monitoring
Monitoring Period	During construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS
Monitoring Frequency	3 Days in a Week
Monitoring Locations	M1, M2
Monitoring Parameters	Dissolved oxygen (DO), temperature, turbidity, salinity, pH, stream flow velocity and suspended solids (SS)
Intervals between 2 Sets of Monitoring	Not less than 36 hours

2.8. POST-CONSTRUCTION MONITORING

Upon completion of the construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS, the monitoring exercise at the designated monitoring locations should be continued for four weeks in the same manner as the baseline monitoring.

Table 2.5 below summarises the proposed monitoring frequency and water quality parameters for post-construction monitoring.

Table 2.5 Proposed water quality post-construction monitoring programme

Item	Baseline Monitoring
Monitoring Period	During a 4-week period after completion of construction of the proposed pipe support and any other construction

Item	Baseline Monitoring
	works adjacent (within 20m) to the Wun Yiu EIS
Monitoring Frequency	3 Days in a Week
Monitoring Locations	M1, M2
Monitoring Parameters	Dissolved oxygen (DO), temperature, turbidity, salinity, pH, stream flow velocity and suspended solids (SS).
Intervals between 2 Sets of Monitoring	Not less than 36 hours

2.9. ACTION AND LIMIT LEVELS

The Action and Limit Levels for water quality are defined in **Table 2.6** below.

Table 2.6 Action and Limit Levels for water quality

Parameters	Action Level	Limit Level
DO in mg/L	5 percentile of baseline data. [1]	4 mg/L or 1 percentile of baseline data. [1]
SS in mg/L	95 percentile of baseline data or 120% of upstream control station of the same day.[2]	99 percentile of baseline data or 130% of upstream control station of the same day. [2]
Turbidity in NTU	95 percentile of baseline data or 120% of upstream control station of the same day.[2]	99 percentile of baseline data or 130% of upstream control station of the same day. [2]

Note:
[1] For DO, non-compliance occurs when monitoring results is lower than the limits.
[2] For SS and turbidity, non-compliance occurs when monitoring results is larger than the limits.

2.10. EVENT AND ACTION PLAN

Should non-compliance of the criteria occur, action in accordance with the Action Plan in the **Table 2.7** below shall be carried out.

Table 2.7 Event and Action Plan for water quality

Event	Action			
	ET	IEC	ER	Contractor
Action level exceedance for one sampling day	1. Repeat in-situ measurement to confirm findings; 2. Inform IEC, contractor and ER; 3. Check monitoring data, all plant, equipment and Contractor's working methods; 4. Review on the source of impact identified by Contractor; 5. Discuss remedial measures with IEC and Contractor and ER; and 6. Repeat measurement on next day of exceedance.	1. Discuss with ET, ER and Contractor on the proposed mitigation measures; 2. Review proposals on remedial measures submitted by Contractor and advise the ER accordingly; 3. Review on the source of impact identified by Contractor; and 4. Review and advise the ET and ER on the effectiveness of the implemented mitigation measures.	1. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 2. Make agreement on the remedial measures to be implemented; 3. Supervise the implementation of agreed remedial measures.	1. Identify source(s) of impact; 2. Inform the ER and confirm notification of the non-compliance in writing; 3. Rectify unacceptable practice; 4.Check all plant and equipment; 5. Consider changes of working methods; 6. Discuss with ER, ET and IEC and propose remedial measures to IEC and ER; and 7. Implement the agreed mitigation measures.
Action level exceedance for more than one consecutive sampling days	1. Repeat in-situ measurement to confirm findings; 2. Inform IEC, contractor and ER;	1. Discuss with ET, Contractor and ER on the proposed mitigation measures; 2. Review the proposed	1. Discuss with ET, IEC and Contractor on the proposed mitigation measures; 2. Make agreement on the	1. Identify source(s) of impact; 2. Inform the ER and confirm notification of the non-compliance in

Event	Action			
	ET	IEC	ER	Contractor
	3. Check monitoring data, all plant, equipment and Contractor's working methods; 4. Review on the source of impact identified by Contractor; 5. Discuss remedial measures with IEC and Contractor and ER; 6. Ensure remedial measures are implemented; and 7. Repeat measurement on next day of exceedance.	remedial measures submitted by Contractor and advise the ER accordingly; 3. Review on the source of impact identified by Contractor; and 4. Review and advise the ET and ER on the effectiveness of the implemented mitigation measures.	remedial measures to be implemented ; and 3. Discuss with ET, IEC and Contractor on the effectiveness of the implemented remedial measures.	writing; 3. Rectify unacceptable practice; 4. Check all plant and equipment and consider changes of working methods; 5. Discuss with ET, IEC and ER and submit proposal of remedial measures to ER and IEC within 3 working days of notification; and 6. Implement the agreed mitigation measures.
Limit level exceedance for one sampling day	1. Repeat in-situ measurement to confirm findings; 2. Inform IEC, contractor and ER; 3. Rectify unacceptable practice; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Review on the source of impact identified by Contractor; 6. Consider changes of	1. Discuss with ET, Contractor and ER on the proposed mitigation measures; 2. Review the proposed remedial measures submitted by Contractor and advise the ER accordingly; 3. Review on the source of impact identified by Contractor; and 4. Review and advise the ET and ER on the	1. Discuss with ET, IEC and Contractor on the proposed remedial measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the remedial measures to be implemented; and 4. Discuss with ET, IEC and Contractor on the effectiveness of the implemented remedial	1. Identify source(s) of impact; 2. Inform the ER and confirm notification of the non-compliance in writing; 3. Rectify unacceptable practice; 4. Check all plant and equipment and consider changes of working methods; 5. Discuss with ET, IEC and ER and submit

Event	Action			
	ET	IEC	ER	Contractor
	working methods; 7. Discuss mitigation measures with IEC, ER and Contractor; 8. Ensure the agreed remedial measures are implemented; and 9. Increase the monitoring frequency to daily until no exceedance of Limit level.	effectiveness of the implemented mitigation measures.	measures.	proposal of additional mitigation measures to ER and IEC within 3 working days of notification; and 6. Implement the agreed remedial measures.
Limit level exceedance for more than one consecutive sampling days	1. Repeat in-situ measurement to confirm findings; 2. Inform IEC, contractor and ER; 3. Check monitoring data, all plant, equipment and Contractor's working methods; 4. Review on the source of impact identified by Contractor; 5. Discuss mitigation measures with IEC, ER and Contractor; 6. Ensure mitigation measures are implemented; and 7. Increase the monitoring	1. Discuss with ET, Contractor and ER on the proposed mitigation measures; 2. Review the proposed remedial measures submitted by Contractor and advise the ER accordingly; 3. Review on the source of impact identified by Contractor; and 4. Review and advise the ET and ER on the effectiveness of the implemented mitigation measures.	1. Discuss with ET, IEC and Contractor on the proposed remedial measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the remedial measures to be implemented; and 4. Discuss with ET and IEC on the effectiveness of the implemented mitigation measures.	1. Identify source(s) of impact; 2. Inform the ER and confirm notification of the non-compliance in writing; 3. Rectify unacceptable practice; 4. Check all plant and equipment and consider changes of working methods; 5. Discuss with ET, IEC and ER and submit proposal of additional mitigation measures to ER and IEC within 3 working days of notification; and

Event	Action			
	ET	IEC	ER	Contractor
	frequency to daily until no exceedance of Limit Level for two consecutive days.			6. Implement the agreed remedial measures.

Note:
ET – Environmental Team
IEC – Independent Environmental Checker
ER – Engineer's Representative

3. ECOLOGY

The PP has assessed the ecological impacts associated with the Project. According to the PP, Wun Yiu Ecological Important Stream (EIS) is listed as EIS by Agriculture, Fisheries and Conservation Department (AFCD). The ecological importance of the Wun Yiu EIS lies in the presence of a rare freshwater fish, *Pseudobagrus trilineatus*, which is a nocturnal species recorded in Hong Kong besides Sai Kung. The fish has been identified as the key species of conservation concern by AFCD and listed as "Near Threatened" by the Red List of China's Vertebrates (2016). Thus, fish surveys at Wun Yiu EIS will be needed before, during, and after the construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS.

3.1. ENVIRONMENTAL MITIGATION DURING CONSTRUCTION PHASE

The PP and EP has recommended mitigation measures on ecological impact during construction phase. The mitigation measures are summarised below:

3.1.1. MITIGATION MEASURES

- water quality monitoring of the Wun Yiu EIS should be carried out before, during and after the construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS. An event and action plan should be provided for relevant parties to take immediate action in case any deterioration in water quality is observed in the monitoring events;
- ecological monitoring of the Wun Yiu EIS should be carried out before, during and after the construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS. The construction process should be supervised by qualified ecologist all the time to ensure that no major impact to the aquatic ecosystem. The details should be agreed with AFCD and EPD before construction;
- the proposed pipe support in the Wun Yiu EIS will be constructed on exposed dry rock surface (instead of the riverbed) above the existing stream course water body. All the construction works involved will be above the water body. Therefore, the water body will be totally untouched during the construction stage;
- both the size of the proposed pipe support and the scale of the construction works involved in the Wun Yiu EIS will be rather small;
- in consideration of the available literature on breeding season of freshwater fish in Hong Kong, no construction works inside the extent of the Wun Yiu EIS will be allowed in spring and the wet season;
- only hand-held tools should be used inside the extent of the Wun Yiu EIS;
- special requirement restricting the future contractor to ensure not disturbing the stream course water body during the future works will be imposed;

- the proposed works site inside or in the proximity of natural rivers and streams should be temporarily isolated, such as placing of sandbags or silt curtains with lead edge at bottom and properly supported props, to prevent adverse impacts on the stream water qualities;
- the natural bottom and existing flow in the river should be preserved to avoid disturbance to the river habitats. No access track on riverbed should be allowed;
- stockpiling of construction materials including cement, if necessary, should be properly covered and protected with deployment of sandbags;
- construction debris and spoil should be covered up and/or properly disposed of as soon as possible to avoid being washed into nearby rivers/streams by rain;
- construction effluent including those from cement grouting, site run-off and sewage should be properly collected and/or treated. Wastewater from a construction site should be managed with the following approach in descending order: (1) minimisation of wastewater generation; (2) reuse and recycle; (3) treatment. Proper locations for discharge outlets of wastewater treatment facilities well away from the natural streams/rivers should be identified;
- adequate lateral support may need to be erected in order to prevent soil/mud from slipping into the stream/river, but without unduly impeding the flow during heavy rain;
- supervisory staff should be assigned to station on site to closely supervise and monitor the works;
- removal of existing vegetation alongside the riverbanks should be avoided or minimised. When disturbance to vegetation is unavoidable, all disturbed areas should be hydroseeded or planted with suitable vegetation to blend in with the natural environment upon completion of works;
- standard good site practice (e.g. hoarding of works areas, placement of equipment or stockpile at designated area, etc.) should be implemented in construction stage to minimize potential disturbance impact;
- practical dust and noise control measures (e.g. regular watering, use of quiet mechanical plant, temporary noise barrier, etc.) should be implemented during construction stage;
- effective site run-off control measures (e.g. provision of surface drainage system, use of sand/silt traps, etc.) should be provided during the construction stage to minimize impacts on adjacent water bodies; and
- No dredging, river training or river diversion shall be allowed in the Project.

3.1.2. SPECIAL MEASURES FOR WORKS AT WUN YIU ECOLOGICALLY IMPORTANT STREAM (WYEIS)

- no construction activity within the water body of WYEIS
- no construction work shall be carried out inside WYEIS in spring and wet seasons;
- only hand-held tools may be used inside WYEIS; and
- the natural bottom and water flow of WYEIS shall be preserved and no access track on riverbed shall be allowed.

3.2. FISH SURVEY

The fish survey within the Study Area shall be conducted by qualified ecologist(s), who shall possess qualification and experience of at least five years in fish surveys and a relevant degree in biology or equivalent, to be able to identify the species of fish of concern. The rare fish species, *Pseudobagrus trilineatus* (AFCD's conservation listing and Red List of China's Vertebrates-2016), will be the key species under the monitoring plan.

EIAO Guidance Note No. 10/2010 Methodologies for Terrestrial and Freshwater Ecological Baseline Surveys shall be referred. Bankside Counts and Netting are selected as the fish survey method considering the rocky terrain of the Wun Yiu EIS. Parameters, Frequency and Method of the prposed fish survey is presented in **Table 3.1**. Night survey will be conducted by at least two surveyors during the baseline and monitoring period. Weekly night surveys will be conducted during the two months baseline period and all fish species will be recorded. Weekly night surveys will be conducted during the whole period of construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS and only the key fish species, *Pseudobagrus trilineatus,* will be recorded. Monthly night survey will be conducted for 12 months after the completion of the proposed pipe support and any other construction works adjacent (within 20m) to the WunYiu EIS and only the key fish species, *Pseudobagrus trilineatus,* will be recorded. Surveys will be conducted at a time when conditions are suitable and safe for observation/netting, i.e. when watercourse is not in spate/following periods of heavy rain.

If the target fish species, *Pseudobagrus trilineatus,* is missing during the construction or post-construction monitoring, daily monitoring will be carried out until the target fish species was recorded again. If the target species was missing continuously for 7 days, cessation of all construction should be implemented in order to identify and rectify any irregularities, where the construction shall be resumed after the target fish species was recorded again or confirmed with no irregularity being brought by the the construction. All survey results will be promptly reported to EPD and AFCD after each monitoring.

Table 3.1 Fish survey Parameters, Frequency and Method

Survey	Survey Frequency	Method
Pre-Construction Baseline Survey	A baseline survey will be conducted before the commencement of the construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS. Weekly night survey will be conducted for two months.	Bankside Counts[1]; Netting[2].
Construction Phase Monitoring	Weekly night survey will be conducted during the whole period of construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS.	Bankside Counts; Netting.
Post-Construction	A monthly night survey will be conducted for twelve months after completion of all construction works of	Bankside; Netting

Survey	Survey Frequency	Method
Monitoring	the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS.	

[1] The method of bankside counting is to direct count along stream bank at selected observation points along the monitored stream. Counting of fish will be started a few minutes after arrival at each observation point to minimize the effects of disturbance. Direct counting of fish with a pair of binoculars will be made for a fixed period of time (at least 20 minutes). All fish species will be recorded during the baseline survey and only the key speices will be recorded during monitoring surveys.
[2] The method of netting is to use a D-framed hand net of about 3-mm mesh size to search for fish at each selected observation points.

3.3. FISH SURVEY LOCATIONS

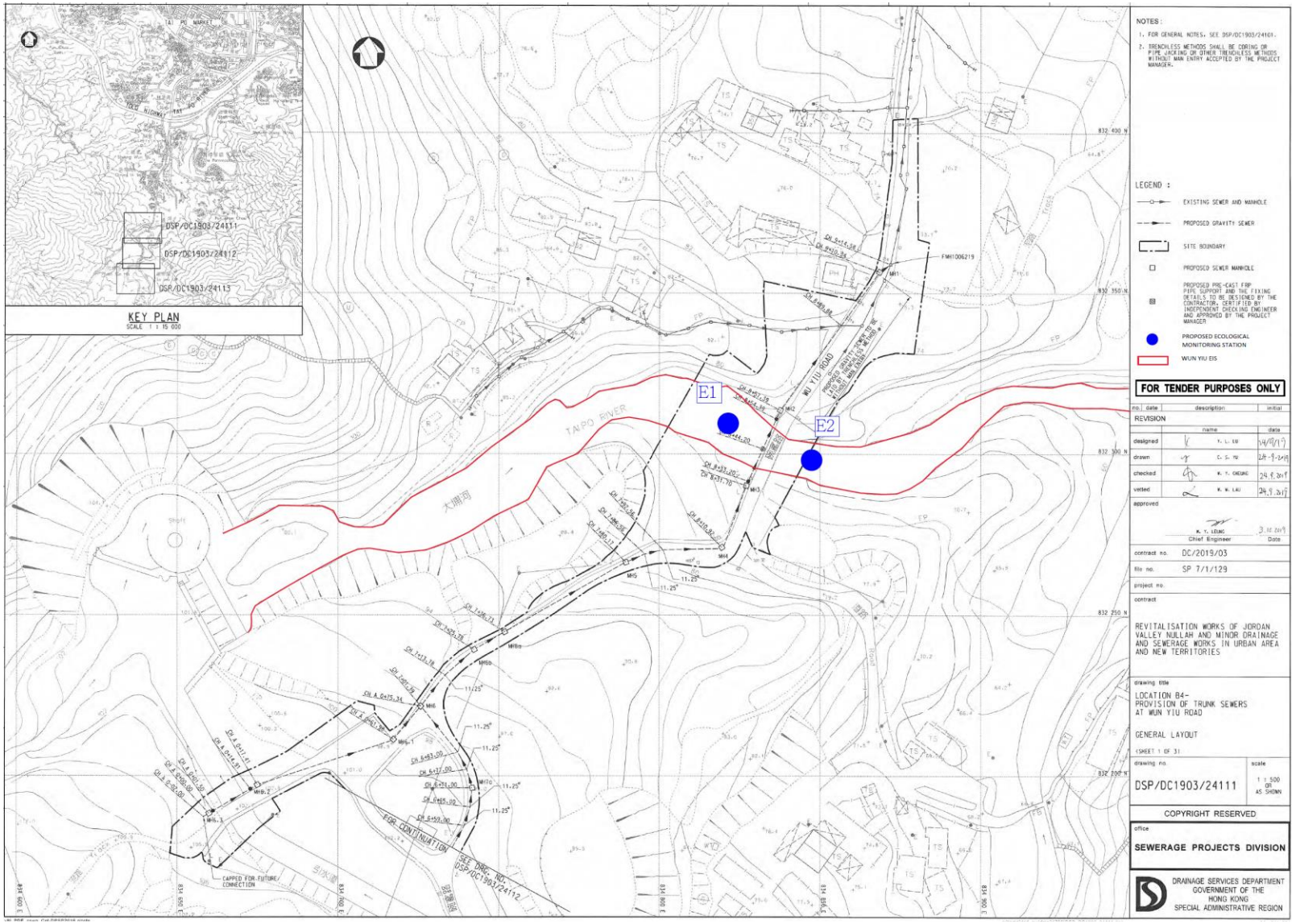
Fish survey will be carried out along the whole stream during baseline survey and the 2 locations (E1&E2) of the stream will be monitored during construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS. Monitoring locations (E1&E2) will be re-confirmed after the baseline survey.

The proposed fish survey locations are shown in **Figure 3.1** and listed in **Table 3.2**. The ET shall seek approval from IEC and EPD for any alternative monitoring locations.

Table 3.2 Locations of proposed water quality monitoring stations

Monitoring Station	Location
E1	Uptream of Wun Yiu Ecologically Important Stream
E2	Downstream of Wun Yiu Ecologically Important Stream

Figure 3.1 Locations of proposed ecological monitoring stations



4. SITE ENVIRONMENTAL AUDIT

4.1. PERFORMANCE MONITORING

The Contractor shall arrange weekly environmental walk to be attended by the Environmental Officer, the Contractor 's Agent, and the Project Manager or his delegate to inspect the Site, checking that the environmental performance of the Site is satisfactory and in compliance with the requirements under this contract. The places to be inspected in the weekly environmental walk shall be determined by the Project Manager or his delegate.

The Contractor may arrange the weekly environmental walk to be carried out along with the weekly safety walk or other site inspections subject to the agreement of the Project Manager. The weekly environmental walks conducted under this clause are entirely without prejudice to and do not relieve any of the Contractor's responsibility to carry out regular inspections to upkeep the environmental performance of the Site as required by the statute or other clauses under this contract.

The Contractor shall prepare and agree with the Project Manager, a comprehensive checklist for use in weekly environmental walk. The checklist will form the basis for assessing the environmental performance of the Contractor on the Site. Any Defect or deficiencies identified in the weekly environmental walk shall be duly recorded in asummary table, a proforma of which is attached at PS Appendix 25.09. More than one table shall be used for recording the defect or deficiencies if the weekly environmental walk for the week is carried out by more than one inspection team.

Immediately after the weekly environmental walk, the summary table shall be agreed and signed by the Contractor's representative and the Project Manager or his delegate attending the weekly environmental walk, and a copy should be kept by the Project Manager. The Contractor shall take prompt action to rectify the deficiencies identified and shall report the status of rectification actions in the forthcoming weekly environmental walk or the SEMC meeting whichever comes first.

The following items should be included in the agenda for discussion at every SEMC meeting and SEC meeting, or other established channelsfor performance monitoring as agreed by the Project Manager:

(i) Review the sufficiency of the measures in the EMP and proposals for improvement;
(ii) Monitor the Contractor's environmental performance and achievement with reference to EMP;
(iii) Assess the effectiveness of EMP taking into account the Contractor's environmental performance and achievement; and
(iv) Monitor the follow-up action by the Contractor on the Defect and deficiencies identified in weekly inspections.

APPENDIX A

Mitigation Measures Implementation Schedule for Water Quality and Ecology

WQEMP ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Implementation Timing & Location	Implementation Agent	Implementation Stage			Relevant Legislation & Guidelines
				D	C	O	
Water Quality							
S2.1.1	Protection of natural watercourses will be in compliance with Environment, Transport and Works Bureau Technical Circular (Works) (ETWB TC(W)) No. 5/2005 《Protection of natural streams/rivers from adverse impacts arising from construction works》	All area / During construction	Contractor(s)		**Y**		Environment, Transport and Works Bureau Technical Circular (Works) (ETWB TC(W)) No. 5/2005 《Protection of natural streams/rivers from adverse impacts arising from construction works》
S2.1.1	Necessary silt removal facilitates will be provided during construction stage so as to remove any silt before discharge of site runoff into nearby stormwater drains.	All area / During construction	Contractor(s)		**Y**		-
S2.1.1	The design of temporary on-site drainage and silt removal facilities will comply with the guidelines stipulated in EPD's Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94).	All area / During construction	Contractor(s)		**Y**	**Y**	Practice Note for Professional Persons, Construction Site Drainage (ProPECC PN 1/94)
S2.1.2	Adequate measures shall be taken to ensure that no pollution or siltation occurs to the gathering grounds.	Works at water gathering grounds (WGG) / During construction	Contractor(s)		**Y**		-
S2.1.2	Temporary drains with silt traps shall be constructed at the boundary of the site priorto the commencement of any earthworks	Works at water gathering grounds (WGG) / During construction	Contractor(s)		**Y**		-
S2.1.2	Regular cleaning of the silt traps shall be carried out to ensure that they function properly at all time.	Works at water gathering grounds (WGG) / During construction	Contractor(s)		**Y**		-

WQEMP ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Implementation Timing & Location	Implementation Agent	Implementation Stage			Relevant Legislation & Guidelines
				D	C	O	
S2.1.2	All excavated or filled surfaces which have the risk of erosion shall be protected from erosion at all time.	Works at water gathering grounds (WGG) / During construction	Contractor(s)		**Y**		-
S2.1.2	Site formation plans shall be submitted to WSD for approval prior to commencement of work.	Works at water gathering grounds (WGG) / During construction	Contractor(s)		**Y**		-
S2.1.2	No structure or temporary works shall be erected in the catchwaters without prior approval of WSD	Works at water gathering grounds (WGG) / During construction	Contractor(s)		**Y**		-
S2.1.2	The Contractor shall be responsible for cleaning frequently any waterworks roads and associated drainage works of mud and debris.	Works at water gathering grounds (WGG) / During construction	Contractor(s)		**Y**		-
S2.1.2	The approval for using the access may be withdrawn on written notice to the Contractor by WSD at their absolute discretion.	Works at water gathering grounds (WGG) / During construction	Contractor(s)		**Y**		-
S2.1.2	The Contractor shall recover immediately his vehicle which fell into the catchwater or stream bed or pay to Government on demand the cost of recovery that may be necessary through the occurrence of any incident caused by the Contractor.	Works at water gathering grounds (WGG) / During construction	Contractor(s)		**Y**		-
S2.1.2	The Contractor shall carry out repair or reinstatement works to the satisfaction of WSD or pay to Government on demand the cost of repair and reinstatement to any waterworks installations that shall or may be	Works at water gathering grounds (WGG) / During construction	Contractor(s)/ Independent Environmental Checker (IEC)/ Environmental Team (ET)		**Y**		-

WQEMP ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Implementation Timing & Location	Implementation Agent	Implementation Stage			Relevant Legislation & Guidelines
				D	C	O	
	necessary at any time as a result of damage caused by the Contractor or others under his charge.						
S2.1.2	The Contractor shall enter and remain on and use the access at his own risk and he shall indemnify the Government of Hong Kong from all claims, costs, damages and expense arising from the use of the access.	Works at water gathering grounds (WGG) / During construction	Contractor(s)		**Y**		-
S2.1.2	No excavation with depth more than 2m shall be permitted within 120m from the centerline of WSD water tunnels without the prior approval of WSD.	Works at water gathering grounds (WGG) / During construction	Contractor(s)		**Y**		-
S2.1.2	All waterworks access roads must be maintained unobstructed at all time.	Works at water gathering grounds (WGG) / During construction	Contractor(s)/ WSD		**Y**	**Y**	-
S2	Water quality monitoring of the Wun Yiu EIS should be carried out before, during and after the construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS. An event and action plan should be provided for relevant parties to take immediate action in case any deterioration in water quality is observed in the monitoring events;	Wokrs at Wun Yiu EIS / Before, during and after construction	Environmental Team		**Y**		-
Ecology							
S3.1.1	The proposed pipe support in the Wun Yiu EIS will be constructed on exposed dry rock surface (instead of the riverbed) above the existing stream course water body. All the construction	All area / During design stage/ During construction	Contractor(s) / WSD	**Y**	**Y**		-

WQEMP ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Implementation Timing & Location	Implementation Agent	Implementation Stage			Relevant Legislation & Guidelines
				D	C	O	
	works involved will be above the water body. Therefore, the water body will be totally untouched during the construction stage.						
S3.1.1	Both the size of the proposed pipe support and the scale of the construction works involved in the Wun Yiu EIS will be rather small.	Works at Wun Yiu Ecologically Important Stream (WYEIS) / During design stage/ During construction	Contractor(s) / WSD	**Y**	**Y**		-
S3.1.1	In consideration of the available literature on breeding season of freshwater fish in Hong Kong, no construction works inside the extent of the Wun Yiu EIS will be allowed in spring and the wet season.	Works at Wun Yiu Ecologically Important Stream (WYEIS) / During construction	Contractor(s)		**Y**		-
S3.1.1	Only hand-held tools should be used inside the extent of the Wun Yiu EIS.	Works at Wun Yiu Ecologically Important Stream (WYEIS) / During construction	Contractor(s)		**Y**		-
S3.1.1	Special requirement restricting the future contractor to ensure not disturbing the stream course water body during the future works will be imposed.	All area / During construction	Contractor(s)		**Y**		-
S3.1.1	The proposed works site inside or in the proximity of natural rivers and streams should be temporarily isolated, such as placing of sandbags or silt curtains with lead edge at bottom and properly supported props, to prevent adverse impacts on the stream water qualities.	All area / During construction	Contractor(s)		**Y**		-

WQEMP ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Implementation Timing & Location	Implementation Agent	Implementation Stage			Relevant Legislation & Guidelines
				D	C	O	
S3.1.1	The natural bottom and existing flow in the river should be preserved to avoid disturbance to the river habitats. No access track on riverbed should be allowed.	All area / During construction	Contractor(s)		**Y**		-
S3.1.1	Stockpiling of construction materials including cement, if necessary, should be properly covered and protected with deployment of sandbags.	All area / During construction	Contractor(s)		**Y**		-
S3.1.1	Construction debris and spoil should be covered up and/or properly disposed of as soon as possible to avoid being washed into nearby rivers/streams by rain.	All area / During construction	Contractor(s)		**Y**		-
S3.1.1	Construction effluent including those from cement grouting, site run-off and sewage should be properly collected and/or treated. Wastewater from a construction site should be managed with the following approach in descending order: (1) minimisation of wastewater generation; (2) reuse and recycle; (3) treatment. Proper locations for discharge outlets of wastewater treatment facilities well away from the natural streams/rivers should be identified.	All area / During construction	Contractor(s)		**Y**		-
S3.1.1	Adequate lateral support may need to be erected in order to prevent soil/mud from slipping into the stream/river, but without unduly impeding the flow during heavy rain.	All area / During construction	Contractor(s)		**Y**		-

WQEMP ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Implementation Timing & Location	Implementation Agent	Implementation Stage			Relevant Legislation & Guidelines
				D	C	O	
S3.1.1	Supervisory staff should be assigned to station on site to closely supervise and monitor the works.	All area / During construction	Contractor(s)		**Y**		-
S3.1.1	Removal of existing vegetation alongside the riverbanks should be avoided or minimised. When disturbance to vegetation is unavoidable, all disturbed areas should be hydroseeded or planted with suitable vegetation to blend in with the natural environment upon completion of works.	All area / During construction	Contractor(s)		**Y**		-
S3.1.1	Standard good site practice (e.g. hoarding of works areas, placement of equipment or stockpile at designated area, etc.) should be implemented in construction stage to minimize potential disturbance impact.	All area / During construction	Contractor(s)		**Y**		-
S3.1.1	Practical dust and noise control measures (e.g. regular watering, use of quiet mechanical plant, temporary noise barrier, etc.) should be implemented during construction stage.	All area / During construction	Contractor(s)		**Y**		-
S3.1.1	Effective site run-off control measures (e.g. provision of surface drainage system, use of sand/silt traps, etc.) should be provided during the construction stage to minimize impacts on adjacent water bodies.	All area / During construction	Contractor(s)		**Y**		-
S3.1.1	No dredging, river training or river diversion shall be allowed in the Project.	All area / During construction	Contractor(s)		**Y**		-
S3.1.2	No construction activity within the water body of WYEIS.	Works at Wun Yiu Ecologically Important Stream	Contractor(s)		**Y**		-

WQEMP ref.	Recommended Environmental Protection Measures/ Mitigation Measures	Implementation Timing & Location	Implementation Agent	Implementation Stage			Relevant Legislation & Guidelines
				D	C	O	
		(WYEIS) / During construction					
S3.1.2	No construction work shall be carried out inside WYEIS in spring and wet seasons.	Works at Wun Yiu Ecologically Important Stream (WYEIS) / During construction	Contractor(s)		**Y**		-
S3.1.2	Only hand-held tools may be used inside WYEIS.	Works at Wun Yiu Ecologically Important Stream (WYEIS) / During construction	Contractor(s)		**Y**		-
S3.1.2	The natural bottom and water flow of WYEIS shall be preserved and no access track on riverbed shall be allowed.	Works at Wun Yiu Ecologically Important Stream (WYEIS) / During construction	Contractor(s)		**Y**		-
S3	Ecological monitoring of the Wun Yiu EIS should be carried out before, during and after the construction of the proposed pipe support and any other construction works adjacent (within 20m) to the Wun Yiu EIS. The construction process should be supervised by qualified ecologist all the time to ensure that no major impact to the aquatic ecosystem. The details should be agreed with AFCD and EPD before construction.	Works at Wun Yiu Ecologically Important Stream (WYEIS) / Before, during and after construction	Environmental Team		**Y**		-

Remarks:
D= Design stage
C= Construction Stage
O= Operation stage

Appendix